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Physics, 5

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Home Electrical Energy Study

Section #1 Circuits

1. It is possible to turn electrical devices on and off without affecting other electrical devices when said devices are on a parallel circuit. Parallel circuits have multiple pathways that allow current to flow in several different directions. Each resistor or electrical device is located on a separate pathway of the parallel circuit. This means that there is an individual pathway that flows from the power source to the resistor and back again that is connected to that device and only that device. Switches can be placed before each resistor to control to which pathways current flows. By flipping a switch on the wall we are allowing the current in the parallel circuit to flow down only the specific pathway of the device we are trying to turn on. By not flipping any additional switches we aren’t allowing the current to reach any of the other pathways, thus not automatically turning on any additional devices just by flipping the switch for say, our bedroom fan.
2. As more electrical devices are turned on, the amount of current flowing through the wires in our home increases. This happens according to Ohm’s Law. When using the equation: I= VR the current (I) is calculated by multiplying the voltage (V) by the resistance (R). As more devices are turned on the total voltage being used in the circuit remains the same at an average of 120 volts. This means that the resistance is the only variable left to increase. The more devices turned on the higher the resistance. As a result of the increase in resistance the current increases as well. Simply put, the current (I) flowing through the circuit increases as the resistance (R) becomes larger, in accordance with the equation I=VR
3. A circuit has a capacity of an average of 15 to 20 amps because the voltage is a constant at 120 volts you can calculate that an average circuit has a capacity of 1800 to 2400 watts. As several electrical devices are turned on the current in the circuit increases. When too many devices connected in the same circuit are turned on at the same time the amount of current flowing through the circuit may reach a number over the capacity of the circuit. When this occurs a switch in the circuit will turn off or a fuse will blow, shutting off all the devices on the circuit and sometimes making them impossible to turn back on again. This is the circuit’s way of protecting itself. By switching off it prevents the overloaded circuits from bursting into flames, something potentially disastrous. Usually power can be restored to the devices by locating the switch in your circuit box and flipping it back on again, or in older models by replacing the blown fuse. This situation can certainly be prevented. By knowing the wattage capacity of the circuits in your home you and how many watts are used by each appliance on that circuit you can make an informed decision about how many or which items you can run on that circuit at any one time making sure as not to exceed the wattage capacity.

Section #2 Energy

1. The two objects in our home that would cost the most per hour would be the clothes dryer and the gas furnace. Obviously the appliance that uses the most watts would cost the most per hour. This is because watts is a measure of the volume of energy each device it drawing to operate. Using the formula of IV=W current or amps being (I), voltage being (V), and watts being (W) I determined which two appliances cost the most to run per hour by reviewing which two used the most amps. Based on the fact the clothes dryer uses 33.3 amps (the largest amount of all the appliances) and the gas furnace uses 13.3 (the second largest amount) I was able to calculate the watts they use by multiplying each of their amp amounts by an average of 120 volts to get 4000 and 1600 watts for the clothes dryer and gas furnace respectively.

The furnace would use the most energy per year. If the watts are calculated by multiplying current by voltage (33.3x120) the end result would be 1600. Multiply kilowatts by hours used per week (1.6x70) and the result is 112 kWh per week, but since we only use the furnace approximately 20 weeks out of the year a more accurate representation of kilowatt hours used per year is 112 multiplied by 20 week to get a grand total of 2240 kWh per year. the Even though the furnace runs only about half the year it consumes approximately twice the amount of energy as the second highest energy consumer: the refrigerator (1092 kWh per year).

My parent’s actually monthly bill and the total monthly amount on my survey are not equal. For this there are many reasons, one of which of is that the time used per week column is roughly an estimate and for some appliances changes from week to week thus increasing or decreasing the bill based on the month. Secondly, for most items I calculated their cost per week based on an average power rating given on the survey. They may actually use a great deal more or less power to operate. Finally, the electrical company charges a different amount per KWh than is estimated on this survey changing the cost to run each appliance per month.

10% Reduction Plain Explanation

Reducing your energy consumption by 10% may not seem much, but as you begin to look for ways to get back on the time you use electrical appliances the solution becomes tricky. I started my reduction plan with an obvious energy consumer: the furnace. Since my parents and I are at school and work during the day we leave the furnace off while we are away. Because parents are rarely home before 7:00pm and I participate in many activities after school the furnace is often forgotten in the evening during a rush of homework and dinner. But by about 9:00pm as we think about getting ready for bed or watching a program on television the chill in the house becomes unbearable and one of us eventually turns on the furnace. We usually keep it on the whole evening and it is forgotten until we get ready to head out the door at 7:00 a.m. So, I propose that instead of waiting until just before we leave for the day we turn the furnace off when we wake up at 6:00 a.m. The house would take at least an hour to get really cold after we turned the furnace off anyway so we’d never know the difference, and we’d be saving an hour of energy every day too.

My next deduction came from the kitchen lights which we use a total of four hours every day. The go on when we wake up in the morning until about 8:00 a.m. when my mother leaves for work. They come back on for dinner and usually remain on for another hour afterwards, forgotten as we watch television or head elsewhere to complete homework. So, I propose that instead of wasting energy and money by leaving the lights on even when we aren’t in the kitchen we switch them off after dinner saving an hour every night.

My final reduction involves my laptop power cord which until recently was on for twenty hours of every day. I only ever unplugged it to work wirelessly on homework and talk with friends for approximately four hours after school every day. But, in reality my laptop isn’t being used during the day at any other time and only needs to charge itself for the amount of time that there is daylight during the day. So I decided to reduce the time it is plugged in by unplugging during the evening while I’m sleeping, a time when I can’t possibly be using it. This saves approximately nine hours of energy every night.